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(54) IMPROVED METHOD OF AND MEANS FOR DISPENSING CARBONATED LIQUIDS FROM CONTAINERS

(71) We, ARTHUR GUINESS SON & COMPANY (DUBLIN) LIMITED, of St. James's Gate Brewery, St James's Gate, Dublin, in the Republic of Ireland, a corporation constituted under the laws of the Irish Republic, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the packaging of beverages in the form of liquids which contain gas in solution. Such beverages (sometimes called "aerated" beverages) may be alcoholic or non-alcoholic.

The invention is concerned with the packaging of such beverages, under pressure, in what are herein termed "non-releasable" containers, by which is meant containers such as cans or bottles, which when broached, totally and irrevocably vent the pressure in the headspace above the liquid contents, so that the gas in solution in the liquid will thereafter evolve when the liquid is dispensed into a drinking vessel. Particularly in the case of alcoholic beverages, there is a tendency for the contents of the container to go "flat", unless they are consumed within a short while after broaching the container. Such containers are normally intended to hold a volume of beverage in the order of two litres or less.

The invention has been developed by the Applicants mainly for use in connection with alcoholic beverages such as beer, (which term shall include stout, ale and lager) which are required to be dispensed in such manner that a "head" of foam shall form in the drinking vessel. It is, however, applicable to other aerated beverages if the requirement for a "head" should exist in the particular consumer market.

Among the qualities normally sought in a head on beverages such as beer, ale and stout, may be listed the following:—

Regularity, by which is meant a consistent bubble size. Fineness, by which is meant a small bubble size, e.g. bubbles up to about 0.010 inches average diameter.

Homogeneity, by which is meant a continuity of bubble structure without the occurrence of large irregularly shaped random gaps.

Endurance, by which is meant the ability of the bubble structure, when it has risen to the surface of the liquor after dispensing into a drinking vessel, to persist during the process of drinking and regardless of whether or not the liquor is quaffed rapidly or sipped slowly.

By the expression "size of head" is meant the volume of froth initially present on the top of the liquor in the drinking vessel, after the beverage has been dispensed and after sufficient time has elapsed for most of the gas in solution to have evolved, and for the majority of the resulting bubbles to have risen to the surface of the liquor.

Considerable research has been carried out by Arthur Guiness Son & Company (Park Royal) Limited, a United Kingdom brewery with which the present Applicants are closely associated, on the provision of a fine and enduring head on beer when dispensed under pressure from a large container such as a cask or keg. In those conditions, the pressure is maintained on the contents of the container during and after dispensing, since the container may normally have a capacity of from 30 to 50 litres. It has been found, as discussed in U.K. Patents Nos. 876,628 and 876,629 that the quality of head may be improved and made more enduring by the use of mixed gases in solution in the beverage, namely an "inert gas" and carbon dioxide and by dispensing the beverage through a tap provided with a restrictor designed to produce a sudden pressure-drop as the beverage is dispensed.

By the term "inert gas" we mean a gas which has the following properties:—

[Price 25p]

SEE ERRATA SLIP ATTACHED

(a) It does not itself react chemically with the liquor and particularly not with beer.

(b) When applied to, or dissolved in the liquor it does not promote or allow, in the liquor after gasification, chemical reactions such as acetification, which in the absence of the inert gas would not tend to take place.

(c) As compared with carbon dioxide:—

(i) It is relatively insoluble in beer, e.g. in the order of less than 5% by volume as compared with 100%.

(ii) It does not have a large effect on the size of head for a given pressure change of the dissolved gases.

(d) It is not harmful to the consumer.

(e) It does not impair the normal taste of the liquor.

The inert gas which clearly satisfies all the above requirements and which we prefer to use, is nitrogen, since this gas is not only "inert" as above defined, but is also inexpensive and non-inflammable. In this latter respect, we believe that hydrogen or methane may be examples of gases which would otherwise satisfy the definition given above but, being inflammable, they would not normally be desirable to use as propellants for draught beer or similar liquor.

In the case of non-releasable containers, the beverage cannot be dispensed under pressure through a restrictor, because the broaching of a bottle or can immediately relieves the original pressure in the container.

The object of the present invention is to provide conditions in a non-releasable container which will enable an aerated beverage to be dispensed into a drinking vessel so as to provide a "head" on the contents of the drinking vessel which is comparable to that which can be obtained when dispensing beer from a large pressurised cask or keg, through a tap provided with a restrictor, as discussed earlier.

According to the present invention there is provided a packaged beverage in the form of a liquid containing gas in solution, sealed into a non-releasable container (as hereinbefore defined) having a main compartment and a smaller subsidiary compartment, and comprising a predetermined volume of the liquid carried in the main compartment under pressure from gas in a headspace above the liquid substantially in equilibrium with the gas in solution in the liquid, and a charge of gas under pressure in the subsidiary compartment; the subsidiary compartment communicating with the main compartment through a fine aperture constituting a restricted flow jet nozzle and located below the surface of the liquid, the arrangement being such that when the container is broached and gas pressure in the headspace above the liquid is suddenly relieved, gas from the charge will vent through the jet nozzle into the liquid, emerging as fine bubbles and acting to "seed" the formation of further fine bubbles in the liquid as the gas evolves out of solution from the liquid.

The invention further includes a method of packaging a beverage in the form of a liquid containing gas in solution, in a sealed non-releasable container (as hereinbefore defined) under pressure from gas in a headspace above the liquid substantially in equilibrium with the gas in solution in the liquid, which comprises providing within the sealed container, an internal charge of gas under pressure, separate from the gas in the headspace, and capable of being vented through fine jet means below the normal liquid level in the filled container; the arrangement being such that when the container is broached and gas pressure in the headspace above the liquid is suddenly relieved, gas from the charge will vent through the jet means into the liquid, emerging as fine bubbles and acting to "seed" the formation of further fine bubbles in the liquid as the gas evolves out of solution from the liquid.

In most instances we prefer that the pressure of the charge of gas in the subsidiary compartment shall also be in equilibrium with that of the gas in the headspace and in solution in the liquid. In the case where there is disequilibrium, valve means may be provided to maintain this disequilibrium so long as the container is sealed, but which opens to release the charge from the subsidiary compartment when the container is broached.

Normally, the volume of the subsidiary compartment will not exceed 10% of the volume of the main compartment.

The invention is applicable to various forms of non-releasable containers, but expected to be chiefly applicable to bottles and cans.

In the case of bottles, the subsidiary gas compartment is conveniently formed as a part of the bottle closure. In the case of cans, the subsidiary gas compartment is conveniently built into the structure of the can.

Three embodiments of the invention will now be described with reference to the accompanying illustrative drawings in which:—

Figure 1 shows a sectional view of a bottle adapted to incorporate the invention.

Figure 2, shows on an enlarged scale, a sectional view of the closure for the bottle of Figure 1, which incorporates a subsidiary gas compartment.

Figure 3, shows a sectional view of one construction of a can incorporating a subsidiary gas compartment.

Figure 4, shows a sectional view of another construction of can incorporating a subsidiary gas compartment.

In Figure 1, a conventional bottle 1, is provided with a closure 2 in the form of a

crimped metal or plastics cap, (commonly termed a "Crown Cap") to the underside of which is attached a tubular compartment 3, which serves to hold the subsidiary charge of gas. The compartment 3 extends below the level of liquid A—A, in the filled bottle.

Referring to Figure 2, the cylindrical gas receptacle 3 is continuous with the cap 2, which is provided with a film of sealing compound 4 to provide a pressure joint with the mouth of the bottle. The end of the receptacle 3 tapers at 5 to a fine nozzle orifice 6, from which the gas will escape in the form of a jet, which will emerge below the surface of the contents of the bottle when the bottle is broached.

One method of charging the bottle 1 and gas receptacle 3, is so arranged for the bottle to be filled and capped in a region of appropriate gas pressure so that, at the end of the operation, the subsidiary gas receptacle 3 is already charged with the appropriate gas, or mixed gases, at the appropriate pressure or partial pressures, in equilibrium with the same gas or mixed gases in solution in the liquid.

Assuming that the bottle is opened in a normal manner, and that the closure is not rapidly lifted away from the bottle, the initial broaching of the bottle will immediately relieve the pressure of gas in the headspace, above the line A—A. As a result of this, the gas (or gases) previously held in solution in the liquid will be free to evolve. At the same time, the charge of gas (or gases) in the subsidiary gas receptacle 3, will escape and be vented, in the form of a jet of fine bubbles, below the level of the liquid. This venting will continue so long as the cap and container are not withdrawn from the bottle. We have found that, in practice, a delay of one or two seconds before removing the cap, is sufficient for the jet of bubbles to initiate the evolution of gas out of the liquid, and to "seed" the formation of further fine bubbles in the liquid. Moreover, once such seeding has begun, it will continue when the contents of the bottle are poured out into a drinking vessel, and an even and fine head of froth will be formed in the drinking vessel, comparable with that obtained when dispensing from the pressurised cask or keg, and considered by most consumers to be superior in texture and quality to that obtainable from a normal bottled aerated beverage.

As an alternative to filling the bottle and charging the gas receptacle 3 in one operation in a region of gas pressure, the receptacle 3 can be sealed, at the nozzle 6, by gelatine or other suitable non-toxic substance intended to dissolve when in contact with the liquid in the bottle. The receptacle can be filled, prior to sealing with an appropriate charge of gas (or gases) at a predetermined pressure (or partial pressures). Conveniently, in such a case, a simple non-return valve may be fitted into the top of the closure cap 2, so that gas can be injected into the receptacle 3 before the closure is applied to the bottle.

The embodiment of the invention illustrated by Figure 3, shows how it may be applied to a conventional can of aerated beverage such as beer.

A canister 10, is constructed to carry, attached to its base 14, a gas receptacle 11. This receptacle has a gas escape tube 12, which is turned over to point downwardly and which terminates in a fine jet orifice 13. This construction is intended to provide a liquid lock for the contents of the gas receptacle in the event that a filled canister is stored in an upside down position. The bottom of the gas receptacle 11, carries a rubber grommet 15, which is self-sealing under internal pressure. Pressurisation of the can may be carried out by hypodermic injection through the grommet 15, or by the use of a conventional non-return valve such as is used, for example, when inflating beach balls.

The canister 10, is filled with beer, containing gas (or mixed gases) in solution, up to a predetermined level indicated by the line B—B. This allows a headspace 16 for gas (or mixed gases) which serve to hold the gas (or mixed gases) in solution in the beer until the canister is broached.

In this embodiment conventional means are provided for broaching the top of a canister, but are not illustrated. For example a tear-off portion may be provided in the top of the canister above the headspace 16.

When the canister is broached, the pressure in the headspace is vented, and as a result the gas in solution in the beer becomes free to evolve. After broaching, gas under pressure will vent through the jet orifice 13 into the beer, in the form of fine bubbles. This has been found to encourage the evolution of gas from the beer, and to provide a fine and even head on the beer when it is dispensed from the canister into a drinking vessel.

The embodiment of the invention illustrated by Figure 4 shows another way of applying it to a conventional can of aerated beverage such as beer.

A canister 20 defines a main compartment 21 and a subsidiary compartment 22, formed by the attachment of a large diameter relatively flat wall 24, to the base 23 of the canister 20. The base 23 carries a rubber grommet 27, which is self-sealing under internal pressure, and the wall 24 of the subsidiary compartment has a downwardly projecting dimple 25, in the base of which is located a fine jet orifice 26.

Under conditions of equilibrium, when the main compartment 21 of the canister 20 has been filled with beverage up to the predetermined level indicated by the line C—C, gas

pressure in the headspace 21A will be in equilibrium with the pressure of gas in solution in the liquid in the main compartment and this pressure, exerted on the upper face of the wall 24, will cause the dimple 25 to be pressed into contact with the upper face of the grommet 27, thus sealing the jet orifice 26.

The subsidiary compartment 22 is pressurised by hypodermic injection through the grommet 27, to a pressure which is fractionally less than the pressure in the main compartment 21. Thus, under packaged conditions, communication between subsidiary compartment 22, and the main compartment 21 is closed because the jet orifice 26 is, as previously explained sealed by contact with the upper face of the grommet 27.

If desired, the wall 24 may initially be given a slight downward spring or bias, in which event it will, of itself, tend to hold the jet orifice 26 in sealing contact with the grommet 27. In such event, the pressure in the subsidiary compartment 22 of an unbroached can may be equal to, or even fractionally greater than that in the main compartment 21.

When the container is broached, by perforating the upper wall 28 of the canister 20, pressure in the headspace 21A is relieved. There is then a pressure differential between the pressure in the subsidiary compartment 22 and that in the main compartment 21 which has now been broached. This will cause the resilient flat wall 24 of the subsidiary compartment 22 to lift slightly, and thus permit escape of the gas from the subsidiary compartment 22 in the form of a fine jet of bubbles into the liquid in the main compartment 21. This jet will act to initiate and encourage evolution of gas out of the liquid, and to "seed" the formation of further fine bubbles in the liquid.

It should be appreciated that this invention is not restricted to the use of mixed gases in solution in the liquid. There may well be circumstances with certain types of beverage, where pressurisation with a single gas (normally carbon dioxide) will be found to be adequate. On the other hand, as earlier mentioned, it has been found, particularly with beverages such as beer, that the use of mixed gases and specially of a mixture of carbon dioxide and an inert gas such as nitrogen, will assist the formation of a fine, regular and enduring head on the beverage when it is dispensed.

The pressures involved are a matter for selection by those responsible for bottling or otherwise packaging the beverage in the containers. The examples which follow, and which relate to the packaging of beer, are merely indicative of pressures which we have found to be satisfactory, particularly when using mixed gases.

In general, for packing beer, we prefer that the gas in solution in the liquor and in the headspace, shall be a mixture of carbon dioxide and an inert gas (as herein defined), and that the partial pressure of carbon dioxide should lie within the range 0.8 to 1.4 kg. per cm. sq. (absolute) and that of the inert gas should lie within the range 0.4 to 2.8 kg. per cm. sq. (absolute). Specifically, when using nitrogen as the inert gas, we have achieved satisfactory results when the partial pressure of carbon dioxide in the mixed gases lies within the range 1.1 to 1.4 kg. per cm. sq. (absolute), and that of the nitrogen lies within the range 2.1 to 2.5 kg. per cm. sq. (absolute).

We normally aim to package the beverage so that the pressure (or partial pressures) of the gas (or mixed gases) in the headspace is substantially in equilibrium with the pressure (or partial pressures) of the same gas (or the same mixed gases) in solution in the beverage. Where a slight difference initially is present, conditions of equilibrium are usually established after the beverage has been packaged for a short time.

In the constructions of Figures 1 to 3, we have also found it preferable, though not essential, that the pressure and nature of the gas or mixed gases in the subsidiary compartment, should be substantially in equilibrium with that or those of the gas or mixed gases in the main compartment. In the construction of Figure 4, as already stated, the pressure in the subsidiary compartment may differ fractionally from that in the main compartment.

There may however, be conditions where it is sufficient to charge the subsidiary compartment with a single gas e.g. carbon dioxide or nitrogen, and if the subsidiary compartment is arranged so that there is a one-way relief valve at the jet nozzle, which will only come into operation to vent the subsidiary compartment after the main compartment has been broached, the pressure in the subsidiary compartment may be less than the pressure (or the sum of the partial pressures) in the main compartment.

WHAT WE CLAIM IS:—

1. A packaged beverage in the form of a liquid containing gas in solution, sealed into a non-releasable container (as herein defined) having a main compartment and a smaller subsidiary compartment, and comprising a predetermined volume of the liquid carried in the main compartment under pressure from gas in a headspace above the liquid substantially in equilibrium with the gas in solution in the liquid, and a charge of gas under pressure in the subsidiary compartment, the subsidiary compartment communicating with the main compartment through a fine aperture constituting a restricted flow jet nozzle, and

located below the surface of the liquid, the arrangement being such that when the container is broached and gas pressure in the headspace above the liquid is suddenly relieved, gas from the charge will vent through the jet nozzle into the liquid, emerging as fine bubbles and acting to "seed" the formation of further fine bubbles in the liquid as the gas evolves out of solution from the liquid.

2. A method of packaging a beverage in the form of a liquid containing gas in solution, in a sealed non-resealable container (as herein defined) under pressure from gas in a headspace above the liquid substantially in equilibrium with the gas in solution in the liquid, which comprises providing, within the sealed container, an internal charge of gas under pressure, separate from the gas in the headspace, and capable of being vented through fine jet means below normal liquid level in the filled container; the arrangement being such that when the container is broached and gas pressure in the headspace above the liquid is suddenly relieved, gas from the charge will vent through the jet means into the liquid, emerging as fine bubbles and acting to "seed" the formation of further fine bubbles in the liquid as the gas evolves out of solution from the liquid.

3. The invention of Claim 1 or Claim 2, wherein the volume of the subsidiary compartment does not exceed 10% of the volume of the main compartment.

4. The invention of Claim 1, 2 or 3, wherein the charge of gas in the subsidiary compartment is not in equilibrium with the gas in the headspace and in solution in the liquid and there is provided valve means which act to maintain the disequilibrium so long as the container is sealed but which opens to release the charge from the subsidiary compartment when the container is broached.

5. The invention of Claim 1, 2 or 3, wherein the pressure of the charge of gas in the subsidiary compartment is substantially in equilibrium with that of the gas in the headspace and in solution in the liquid.

6. The invention of Claim 1 or Claim 2, wherein the beverage is beer.

7. The invention of any of the preceding claims wherein the gas in solution in the liquor and in the head space is a mixture of carbon dioxide and an inert gas (as hereinbefore defined).

8. The invention of Claim 7, wherein the partial pressure of carbon dioxide in the mixed gases lies within the range 0.8 to 1.4 kg. per cm. sq. (absolute) and that of the inert gas lies within the range 0.4 to 2.8 kg. per cm. sq. (absolute).

9. The invention of Claim 7 or Claim 8, wherein the inert gas is nitrogen.

10. The invention of Claim 9, wherein the partial pressure of carbon dioxide in the mixed gases lies within the range 1.1 to 1.4 kg. per cm. sq. (absolute), and that of the nitrogen lies within the range 2.1 to 2.5 kg. per cm. sq. (absolute).

11. A packaged beverage which contains gas in solution, sealed into a non-releasable container, substantially as herein described with reference to Figures 1 and 2, or with reference to Figure 3 or Figure 4, of the accompanying illustrative drawings.

12. A method of packaging a beverage which contains gas in solution in a non-resealable container, substantially as herein described with reference to Figures 1 and 2, or with reference to Figure 3 or Figure 4 of the accompanying illustrative drawings.

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1266351 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.1

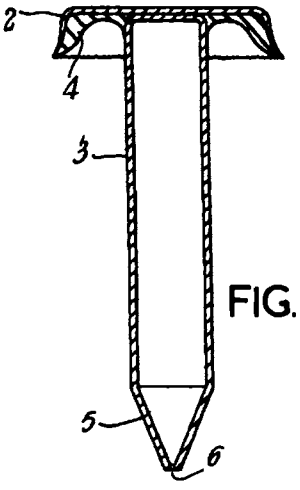

FIG.2

FIG.3

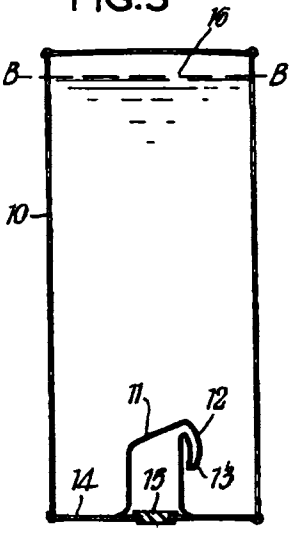

FIG.4